CLAIMS

We claim:

1. A light emitting device having a stack of layers including semiconductor layers comprising an active region, said device comprising:

a transparent lens bonded to said stack.

2. The light emitting device of Claim 1, wherein a shape of said lens is selected from the group consisting of Weierstrass sphere, hemisphere, portions of a sphere less than a hemisphere, ellipsoid, and portions of an ellipsoid.

3. The light emitting device of Claim 1, wherein said lens is a Fresnel lens.

4. The light emitting device of Claim 1, wherein said lens is a graded index lens.

5. The light emitting device of Claim 1, wherein said lens is formed from a material selected from the group consisting of optical glass, III-V semiconductors, II-VI semiconductors, group IV semiconductors and compounds, metal oxides, metal fluorides, diamond, yttrium aluminum garnet, and combinations thereof.

6. The light emitting device of Claim 1, wherein said lens is formed from a material selected from the group consisting of zirconium oxide, sapphire, GaP, ZnS, and SiC.

7. The light emitting device of Claim 1, wherein said lens includes one or more luminescent materials that convert light of a wavelength emitted by said active region to at least another wavelength.

8. The light emitting device of Claim 1, wherein said lens is coated with one or more luminescent materials that convert light of a wavelength emitted by said active region to at least another wavelength.

9. The light emitting device of Claim 1, wherein said lens is bonded to a surface of said stack, and wherein a smallest ratio of a length of a base of said lens to a length of said surface is greater than about one.

10. The light emitting device of Claim 9, wherein said ratio is greater than about two.

11. The light emitting device of Claim 1, wherein said stack is located in a recess of a surface of said lens.

12. The light emitting device of Claim 1, wherein a refractive index of said lens for light emitted by said active region is greater than about 1.5.

13. The light emitting device of Claim 12, wherein said refractive index is greater than about 1.8.

14. The light emitting device of Claim 1, wherein a refractive index of said lens is greater than or equal to a refractive index of said semiconductor layers for light emitted by said active region.

15. The light emitting device of Claim 1, further comprising contacts electrically coupled to said semiconductor layers to apply a voltage across said active region.

16. The light emitting device of Claim 15, wherein at least one of said contacts is highly reflective for light emitted by said active region and is located to reflect said light toward said lens.

17. The light emitting device of Claim 1, further comprising at least one beveled side located to reflect light emitted from said active region toward said lens.

18. The light emitting device of Claim 1, further comprising at least one layer highly reflective for light emitted by said active region located to reflect said light toward said lens.

19. The light emitting device of Claim 1, wherein said transparent lens is directly bonded to at least one of said semiconductor layers.

20. The light emitting device of Claim 1, wherein said stack comprises a transparent superstrate layer disposed above said semiconductor layers and directly bonded to said lens.

21. The light emitting device of Claim 20, wherein said superstrate layer has a refractive index for light emitted by said active region greater than about 1.8.

22. The light emitting device of Claim 20, wherein said superstrate layer is formed from a material selected from the group consisting of sapphire, SiC, GaN, and GaP.

23. The light emitting device of Claim 20, wherein said lens is formed from ZnS, said superstrate is formed from a material selected from the group consisting of SiC, GaN, and sapphire, and said semiconductor layers comprise III-Nitride semiconductors.

24. The light emitting device of Claim 20, wherein said lens is formed from GaP, said superstrate is formed from a III-Phosphide material, and said semiconductor layers comprise III-Phosphide semiconductors.

25. The light emitting device of Claim 1, further comprising a transparent bonding layer disposed between said lens and a surface of said stack, said transparent bonding layer bonding said lens to said stack.

26. The light emitting device of Claim 25, wherein said transparent bonding layer is formed from a material selected from the group consisting of optical glass, chalcogenide glass, III-V semiconductors, II-VI semiconductors, group IV semiconductors, organic semiconductors, metals, metal oxides, metal fluorides, yttrium aluminum garnet, phosphides, arsenides, antimonides, nitrides, and combinations thereof.

27. The light emitting device of Claim 25, wherein said transparent bonding layer includes one or more luminescent materials that convert light of a wavelength emitted by said active region to at least another wavelength.

28. The light emitting device of Claim 25, wherein said bonding layer has an index of refraction greater than about 1.5 for light emitted by said active region.

29. The light emitting device of Claim 28, wherein said index of refraction is greater than about 1.8.

30. The light emitting device of Claim 25, wherein said bonding layer has a thickness less than about 500 Angstroms.

31. The light emitting device of Claim 25, wherein said surface includes a surface of one of said semiconductor layers.

32. The light emitting device of Claim 25, wherein said surface includes a surface of a transparent superstrate layer disposed above said semiconductor layers.

33. The light emitting device of Claim 32, wherein said superstrate layer has a refractive index for light emitted by said active region greater than about 1.8.

34. The light emitting device of Claim 32, wherein said superstrate layer is formed from a material selected from the group consisting of sapphire, SiC, GaN, and GaP.

35. The light emitting device of Claim 32, wherein said lens is formed from ZnS, said superstrate is formed from a material selected from the group consisting of SiC, GaN, and sapphire, and said semiconductor layers comprise III-Nitride semiconductors.

36. The light emitting device of Claim 32, wherein said lens is formed from GaP, said superstrate is formed from a III-Phosphide material, and said semiconductor layers comprise III-Phosphide semiconductors.

37. A method of bonding a transparent lens to a light emitting device having a stack of layers including semiconductor layers comprising an active region, the method comprising:

elevating a temperature of said lens and said stack; and

applying a pressure to press said lens and said stack together, thereby bonding said lens to said stack.

38. The method of Claim 37, wherein said temperature is elevated to less than about 500°C.

39. The method of Claim 37, further comprising disposing one or more high diffusivity materials between said lens and said stack.

40. The method of Claim 37, further comprising doping at least one of said lens and said stack with a high diffusivity material.

41. The method of Claim 37, further comprising disposing a layer of a transparent bonding material between said lens and a surface of said stack.

42. The method of Claim 41, wherein said bonding material comprises an optical glass, and wherein said temperature is elevated to about a strain point temperature of said optical glass.

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